# Screening for intellectual disability in persons with a substance abuse problem: Exploring the validity of the Hayes Ability Screening Index in a Dutch-speaking sample

Wing Ting To[1,2], Stijn Vanheule[3], Wouter Vanderplasschen[2], Kurt Audenaert[4], & Stijn Vandevelde[2]

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1. University College Ghent, Faculty of Education, Health and Social Work
Voskenslaan 362, 9000 Ghent, Belgium
2. Ghent University, Department of Special Education
Henri Dunantlaan 2, 9000 Ghent, Belgium
3. Ghent University, Department of Psychoanalysis and Clinical Consulting
Henri Dunantlaan 2, 9000 Ghent, Belgium
4. Ghent University, Department of Psychiatry and Medical Psychology
De Pintelaan 185, 9000 Ghent, Belgium

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**Corresponding author:**
Wing Ting To
Henri Dunantlaan 2
9000 Ghent,
Belgium
wingting.to@hogent.be /wingting.to@ugent.be

**Abstract**

There is an increasing interest in screening instruments to detect Intellectual Disability (ID) in a quick and accurate way in mental health services as well as in the criminal justice system in order to provide appropriate support for people with undetected needs caused by ID. An instrument that has been proven to be useful in both settings is the Hayes Ability Screening Index (HASI). This study assessed the validity of the Dutch version of the HASI in persons with a substance abuse problem residing in mental health services, whether or not mandated to treatment by court order. The HASI was conducted along with the Wechsler Adult Intelligence Scale III as the criterion for validity to 90 participants. Additionally, the influence of psychiatric disorder and medication use on the HASI result was examined. A significant positive relationship was found between the two instruments, demonstrating convergent validity. Using a Receiver Operating Characteristic (ROC) curve analysis, the discriminative ability of the HASI with a cut-off score of 85 was found to be adequate, yielding in a good balance between sensitivity and specificity. The HASI was not distorted by the presence of the substance abuse problem or other psychiatric illnesses and medication did not influence the HASI scores in this study. These findings indicate that the HASI provides a time-efficient and resource-conscious way to detect ID in persons with a substance problem, thus addressing a critical need in mental health settings.

## 1. Introduction

There is an increasing interest in the early identification of intellectual disability (ID) in persons who come in contact with the criminal justice system (CJS; e.g. Ford et al., 2008; Hayes, 2002; McKenzie, Michie, Murray, & Hales, 2012; Sondenaa, Rasmussen, Palmstierna, & Nottestad, 2008) and/or the mental health system (MHS; e.g. Sondenaa, Bjorgen, & Nottestad, 2007; Sondenaa, Nygard, Nottestad, & Linaker, 2011).

In criminal justice settings, some authors have suggested that intellectual disabilities might reduce the ability to cope with the demands of the CJS (Clare & Gudjonsson, 1993; Gudjonsson & Sigurdsson, 2003; Hayes, 2005; Jones, 2007). For example, clients with ID tend to be unaware of their legal rights, tend to over-estimate the power of police and other authority figures, and tend to be more compliant or suggestible, especially in relation to authority figures (e.g. Clare & Gudjonsson, 1993; Gudjonsson & Sigurdsson, 2003; Hayes, 2005; Jones, 2007). Therefore, it is of great importance to timely and accurately identify ID, so that appropriate interventions, protective measures and dispositions can be implemented at all stages of the criminal justice process (Hayes, 2005).

In mental health settings, the failure to systematically identify clients with ID might interfere with standard treatment protocols, which often do not systematically take into account the specific needs of individuals with ID. Early identification is important in order to provide appropriate support and treatment that takes into account clients' cognitive limitations. When the presence of ID is not recognized, the individual may wrongfully be considered as being uncooperative, behaviorally disordered, or psychological disturbed (Hayes, 2005, 2007). A misinterpretation of behavior or misdiagnosis, e.g. of a mental illness instead of ID, may lead to a placement in a unit which is inappropriate to meet the needs of the individual and will ultimately result in ineffective interventions (Hayes, 2005, 2007).

More specifically, this appears to be critical in mainstream addiction services, where the appropriate resources to identify and treat this specific population are often lacking (Degenhardt, 2000; Lance & Longo, 1997; Lottman, 1993; McGilllicudy, 2006; Ruf, 1999; Slayter & Steenrod, 2009; Sturmey, Reyer, Lee, & Robek, 2003; Taggart, Huxley, & Baker, 2008; Tyas & Rush, 1991; VanderNagel, Kiewik, Buitelaar, & De Jong, 2011). It is acknowledged that compared to substance abusers without ID substance abusers with ID are less likely to receive treatment or to remain in treatment (Chapman & Wu, 2012). During treatment, cognitive impairments in persons with substance abuse problems contribute to poorer treatment outcomes, including decreased treatment retention and less abstinence (Copersino et el., 2009). Interestingly, research has shown a possible link between substance abuse and offending behavior in persons with ID, indicating that substance (ab)use in persons with ID may be a risk factor for involvement in the CJS (McGillivray & Moore, 2001; To, Neirynck, Vanderplasschen, Vanheule, & Vandevelde, 2014).

A routine screening or comprehensive assessment for intellectual disability is, however, not a standard procedure in the criminal justice and mental health systems, including addiction services. A diagnosis of 'intellectual disability' is defined by three aspects: 1. Significantly impaired intellectual functioning (i.e an intelligence quotient of 70 or below), 2. Significantly impaired adaptive functioning, and 3. With onset before the age of 18 (American Association of Intellectual and Developmental Disabilities, 2010). Further, a diagnosis should be made by using valid and reliable assessments of intelligence (e.g. Wechsler Adult Intelligence Scale III) and adaptive functioning as well as taking the developmental history into account to determine if the disability was present before age 18. Such assessment of intellectual disability is often time-consuming, resource intensive and requires qualified personnel. Usually, referrals for full-scale diagnostic assessment generally only occur when intellectual difficulties are suspected, leading to an underestimation of the prevalence of

intellectual disability in these settings (Hayes, 2007; Herrington, Hunter, & Harvey, 2005). Therefore, valid and reliable screening tools that provide an indication of intellectual disability should more globally be implemented in CJS and MHS. This might make professionals aware of possible ID, and assist in decision-making about further diagnostic assessment.

A screening tool that has been used in the criminal justice and mental health systems is the Hayes Ability Screening Index (HASI; Hayes, 2000). It is a brief instrument to screen for intellectual disability. The HASI can be administered by any trained staff in 5 to 10 minutes. The screening results in a score or index which, when compared with an age-appropriate cut-off score, suggests whether referral for further assessment is necessary or not. The HASI has been shown to be a valid, user-friendly and time-saving instrument for screening ID in the Australian criminal justice system (Hayes, 2002). The study of Hayes (2002) found significant relationships with large effect size between the HASI and the Kaufman Brief Intelligence Test (KBIT; $r = 0.627$; $p < 0.05$) and the Vineland Adaptive Behavior Scales (VABS; $r = 0.497$; $p < 0.01$), indicating convergent validity. The Receiver Operating Characteristic (ROC) curve analysis with a HASI cut off score of 85 showed a sensitivity of 82.4% for the KBIT, 71.2% for VABS and specificity of 71.6% for the KBIT and 71.2% for the VABS. However, in an adolescent offender sample in the United Kingdom the HASI was reported not having adequate specificity to be helpful in identifying possible ID (Ford et al., 2008). Ford and his colleagues (2008) observed significant relationships between the HASI and the Wechsler Adult Intelligence Scale -III (WAIS-III; $r = 0.553$; $p < 0.01$) and the VABS ($r = 0.377$; $p < 0.01$). However, the Receiver Operating Characteristic (ROC) curve analysis with a HASI cut off score of 85 only presented a specificity of 65.2% and a sensitivity of 80%. In Norway, the instrument has been demonstrated to be valid in an offender as well as in a non-offender sample, but a lower cut-off value than the original cut-off value of 85 was

suggested (Sondenaa, Bjorgen, & Nottestad, 2007; Sondenaa, Nygard, Nottestad, & Linaker, 2011; Sondenaa, Rasmussen, Palmstierna, & Nottestad, 2008). In an offender sample of inmates of six prisons, Sondenaa and his colleagues (2008) found a significant relationship with large effect size between the HASI and the Wechsler Abbreviated Scale of Intelligence (WASI; $r = 0.717$; $p < 0.001$) and the Receiver Operating Characteristic (ROC) curve analysis with a HASI cut off score of 85 showed a sensitivity of 93.3% and specificity of 72.4%. The two non-offender samples also demonstrated the HASI to be valid. Sondenaa and colleagues (2007) found a significant relationship with large effect size between the HASI and the WAIS-III ($r = 0.81$; $p < 0.001$) and the Receiver Operating Characteristic (ROC) curve analysis with a HASI cut off score of 85 showed a sensitivity of 100% and specificity of 57%. In 2011, Sondenaa and colleagues (2011) observed a significant relationship with large effect size between the HASI and the WASI ($r = 0.67$; $p < 0.001$) and the Receiver Operating Characteristic (ROC) curve analysis with a HASI cut off score of 85 showed a sensitivity of 100% and specificity of 35.4%.

For the Dutch language version of the HASI the validity has never been examined. To address this gap, the present study investigates the validity of the HASI for substance abusers, whether or not mandated to treatment by court order. The study is carried out in Flemish (the northern Dutch-speaking part of Belgium) mental health services, using the Dutch version of the Wechsler Adult Intelligence Scale III (WAIS-III; Wechsler, 2004) as the criterion for validity. Additionally, this study examines whether having a psychiatric disorder affects the results on the HASI, since it has been suggested that the HASI might be over-inclusive, possibly identifying individuals suffering from a psychiatric illness as having an ID (Hayes, 2000, 2002). Finally, the possible impact of using psychotropic medication on the HASI performance is considered, as participants often use medication that might influence their performance.

## 2. Method

### 2.1. Sample

Participants were 90 Caucasian Dutch-speaking adult clients with a substance abuse problem receiving support from eight Flemish mental health services. The data collection took place in two phases. In the first phase, four addiction services were included into the study. This resulted in 73 participants, whereof no one had an IQ of 70 or below. Searching for persons with ID to validate the HASI, 17 additional participants were recruited from a broader array of mental health services than addiction services to search for participants with a substance abuse problem and a possible ID. In the second phase, four additional mental health institutions were included into the study, whereof two general mental health services and two care centers for persons with an intellectual disability. To be eligible for the study, the participants had to meet the following criteria: 1. substance abuse problem was conceptualized as defined by Vanderplasschen, Mostien, Claeys, Raes, & Van Bouchaute (2001: 22): "*problems occurring in one or more life domains resulting from alcohol, psychotropic drug and illegal substance use*", 2. abstinence of all drugs of abuse (other than nicotine) for at least two weeks to exclude acute intoxication or withdrawal, 3. age 18 or older, 4. not have been tested with the WAIS-III during the last two years, and 5. Dutch is the mother tongue.

### 2.2. Procedures and instruments

After providing informed consent, participants were asked some demographic questions, a question about psychiatric disorder ('have you ever been in treatment for a psychiatric disorder [not substance abuse or dependence]?' yes/no), a question about the voluntariness of their treatment (is this treatment voluntarily or under judicial conditions?' yes/no) and for a

subgroup of the sample a question was asked about the perceived influence of their medication on concentration, attention and memory (‘At this moment, do you have the feeling that you are less able to concentrate, are less attentive or that you are less able to recall things because of your medication?’ influence/no influence). Related to the last self-report question a list of their current medication was asked along with the duration of this medication usage, the dosage, and any change of dosage in the last month in order to check this subjective feeling with the expertise of a psychiatrist who rated the medication schemes based on anonymous data.

Next, the instruments were administered to each participant at a single time point, which took up approximately 2.5h. Assessments were carried out by the first author, who is a clinical psychologist and by graduate students of the Faculty Psychology and Special Education at Ghent University after extensive training and under supervision of the first author. The study measures included the Dutch version of the Hayes Ability Screening Index (HASI) and the Dutch version of the Wechsler Adult Intelligence Scale-III (WAIS-III). The tests were counterbalanced to preclude possible test order effects.

The HASI consists of four subtests: background information and three short tests measuring spelling, visuo-spatial and visuo-constructional ability. The first subtest contains four self-report questions sensitive to school difficulties, the subject’s self-awareness about their learning difficulties, and the subject’s social economic and social status. The second subtest is backward spelling. Subjects need to spell a five-letter word backwards. For the Dutch version of the HASI, the word ‘GROND’ (English: soil) is used. The third subtest is a puzzle task (based on the Trail Making test part B) where the subjects need to draw lines between a pattern of numbers and letters. The last subtest is the clock-drawing test. The subjects need to draw a large clock and put the hands of the clock on a specific time. The assessment results in an index that had been found to correlate significantly with those on the

Kaufman Brief Intelligence Test and on the Vineland Adaptive Behavior Scales (Hayes, 2002). The HASI also correlated significantly with the WASI (Sondenaa et al., 2008, 2011) and the WAIS-III (Ford et al., 2008; Sondenaa et al., 2007). Using the original HASI cut-off score of 85 (Hayes, 2002), previous research using a Receiver Operating Characteristic (ROC) curve analysis have reported a sensitivity of 100% using the WAIS-III (Sondenaa et al., 2007) or WASI (Sondenaa et al., 2011) as a criterion validity and a specificity of 35.4% when using the WASI (Sondenaa et al., 2011), and 57% when using the WAIS-III (Sondenaa et al., 2007) as a criterion for validity.

The Dutch version of the Wechsler Adult Intelligence Scale III (WAIS-III; Wechsler, 2004) was used as a criterion of validity in this study. The Wechsler intelligence scales yield in standard index scores for different facets of intelligence, as well as a full scale IQ, a verbal IQ and a Performance IQ. Standardized scores have a mean of 100 and a standard deviation of 15. A score which is two standard deviations or more below the mean, i.e. 70 or lower, indicates significantly impaired functioning and is clinical in terms of the diagnostic criteria for intellectual disability.

### 2.3. Data analysis

The data were analyzed using SPSS version 20. The convergent validity of the HASI was examined using Pearson two-tailed correlations between the HASI and the WAIS-III. The discriminant ability of the HASI was tested using a Receiver Operating Characteristic (ROC) curve analysis. Further, the influence of having a psychiatric disorder and the influence of the taken medication on the HASI score were examined using linear regression analysis, in which the full WAIS-III IQ score was also included as an independent variable. Lastly, to predict with what certainty the HASI classification can predict a correct WAIS-III classification a logistic regression was conducted.

2.4. Ethical approval

Ethical approval was obtained from the Ethics Committee of the University Hospital Ghent (2012/191) and from the Ethics Committee of the Faculty of Psychology and Educational Sciences at Ghent University (2012/11).

## 3. Results

3.1. Descriptive statistics

Information was obtained from 90 Caucasian Dutch-speaking adult clients with a substance abuse problem receiving support from eight Flemish mental health services. On average, the participants were 32 years old (*sd* = 9.795, min = 18; max = 64, n = 90). Most participants were male (83.3%, n = 90), did not had psychiatric treatment in their lifetime (74.4%, ‘n = 90) and were voluntarily in treatment (87.8%, n = 90). Just over half of the participants (of a subgroup of the sample) did not report any possible influence of their current medication on concentration, attention and memory (57.6%, n = 33). The average IQ of the sample measured by the WAIS-III was 88.87 (*sd* = 15.09, n = 90), with a minimum of 50 and a maximum of 126. Eleven of the 90 participants met the criteria for ID in terms of WAIS-III IQ (score $\leq$ 70), 15 participants had an IQ score of 75 or below, and 36 had IQ scores of 85 of below. The average HASI score of the sample was 86.75 (*sd* = 10.20, n = 90) with a minimum of 53.7 and a maximum of 96.4.

3.2. Convergent validity

The convergent validity was indicated by a significant Pearson two-tailed correlation between the HASI scores and the WAIS-III full-scale IQ scores ($r$ = 0.694; $p$ < 0.001). Furthermore, the correlations between the HASI subtests and the WAIS-III were all

significant: background information (Pearson two-tailed $r = 0.58$; $p < 0.001$), spelling (Pearson two-tailed $r = 0.50$; $p < 0.001$), puzzle (Pearson two-tailed $r = 0.46$; $p < 0.001$), and clock drawing (Pearson two-tailed $r = 0.45$; $p < 0.001$). The HASI also correlated significantly with the verbal subscale of the WAIS-III (Pearson two-tailed $r = 0.696$; $p < 0.001$) and the performance subscale of the WAIS-III (Pearson two-tailed $r = 0.629$; $p < 0.001$).

### 3.3. Discriminative ability

The HASI and the WAIS-III full-scale IQ scores are plotted in Figure 1, which illustrates the distribution of the scores. Overall, 72 participants were correctly classified by the HASI. The HASI reported 1 false negative result and 17 false positive results.

The ability of the HASI to discriminate between those with and without an intellectual disability measured by the WAIS-III in this sample was examined using a Receiver Operating Characteristic (ROC) curve analysis. The area under the curve was found to be 0.953, indicating a significant ability ($p < 0.001$) to discriminate between the two groups. Using the original HASI cut-off of 85, as suggested by Hayes (2002), it showed a sensitivity of 91%. The sensitivity is the percentage of the tested participants with an IQ of 70 or below that the HASI correctly identified as present. The specificity was found to be 80%. This is the percentage of the tested participants without an IQ of 70 or below whom the HASI correctly identified as not present. The sensitivity and specificity of the HASI at various cut-off scores are presented in Table 1. Increasing the cut-off from 85 by one point to 86 will increase the sensitivity to 100%, without losing to much specificity (from 80% to 79%).

The influence of having a psychiatric disorder or not (‘PSY’) on the HASI score was examined using linear regression analysis, in which the full WAIS-III IQ score was also included as an independent variable. The WAIS-III score explained a significant amount of

variance in the HASI score: the higher the score on the WAIS-III the higher the score obtained on the HASI ($F$ = 81.69, $p < 0.001$, $\beta$ = .469, $R^2$ = 48%). Adding the variable PSY to the model did not significantly contribute to explaining the variability in the HASI ($\Delta F$ = 0.189, $p$ = 0.66, $\Delta R^2$ = 0.1%).

For a subset of the sample (n = 61), the influence of current medication on concentration, attention and memory was self-reported. In total, 47 participants took medication at the moment of testing. The self-report question significantly correlated (Kendal Tau-b = 0.46; $p <$ 0.01) with the assessment of the psychiatrist based on the information of their medication use at the time of the testing, indicating that their subjective perception of their medication influence was generally reliable. Since the subjective findings correlated significantly with the more objective evaluation of the psychiatrist, only the subjective experience is used in the analysis. The subjective influence of the taken medication or not ('MED') on the HASI score was examined using linear regression analysis, in which the full WAIS-III IQ score was also included as an independent variable. Adding this variable MED to the model did not significantly contribute to explaining the variability on the HASI ($\Delta F$ = 0.838, $p$ = 0.37, $\Delta R^2$ = 0.1%)

Lastly, to predict with what certainty the HASI classification (cut-off 85) can predict a correct WAIS-III classification a logistic regression was conducted. The dependent variable 'WAIS-III 2 categories' measured whether someone had an intellectual disability based on the WAIS-III and equaled 1 if the respondent had an IQ score of 70 or below and equaled 0 if otherwise. The analysis resulted in a significant effect (Wald = 11.45, $p$ = .001, $\beta$ = 3.673, Nagelkerke $R^2$ = 41%), demonstrating that if a person is categorized as possibly intellectual disabled by the HASI, a probability of 62% is found that that person will be categorized as intellectually disabled by the WAIS-III.

## 4. Discussion

This study examined the validity of the HASI as a screening tool in mental health services for persons with a substance abuse problem. The convergent validity as well as the discriminative ability of the HASI was examined using the WAIS-III as a criterion of validity. This study further tested the possible influence of having a psychiatric disorder on the HASI score, and for a subgroup of the sample also examined whether medication had influenced the HASI performance.

In relation to the convergent validity, a significant positive relationship was found between the full scale IQ of the WAIS-III and the HASI score, indicating that the higher the IQ score of a person, the higher the HASI score will be. This finding is congruent with results from previous studies (Ford et al., 2008; Sondenaa et al., 2007, 2008, 2011). The correlation of 0.69 in this study lies within the range of results of previous studies using the WAIS-III as a criterion of validity: Sondenaa et al. (2007) found a correlation of 0.81 in a psychiatric setting, whereas Ford et al. (2008) found a correlation of 0.55 in an adolescent offender sample. This study found that the HASI correlated both significantly, but better with verbal IQs than the performance IQs from the WAIS-III, which is in line with the findings of Sondenaa et al. (2007).

The discriminant ability of the HASI was examined using ROC curve analysis. The analysis showed a sensitivity and specificity of the HASI (cut-off at 85) of 80% and above, which is considered to be acceptable (Glascoe, 2005; McKenzie, Michie, Murray, & Hales, 2012). Consequently, we conclude that the HASI cut-off of 85 might be effective for use among persons with a substance abuse problem in general mental health services: it is sensitive enough in selecting persons with an intellectual disability, and at the same time also detects persons without an intellectual disability. The ability of the HASI to screen for ID in

this specific group of persons with a substance abuse problem further demonstrated that the HASI is able to screen well, without being too over-inclusive identifying persons with a substance abuse problem as having an ID problem, as suggested by Hayes (2000, 2002). Improving the sensitivity to 100% in our sample while keeping the sensitivity of the instrument at a similar level could be achieved by increasing the cut-off score to 86. This finding is in contrast to the findings of Sondenaa et al. (2007, 2008, 2011) and Ford et al. (2008), who observed that with a higher cut-off score the HASI was too over-inclusive, and yielded a high number of false positives. They suggest lowering the cut-off score of 85 for better specificity. McKenzie et al (2012), on the other hand, recommended that a higher cut-off score should be adopted in forensic settings in order to increase the sensitivity of the screening tool, enabling the identification of potentially vulnerable individuals in line with the original idea of Hayes (2002). In this study, the original cut-off score of 85 proved to be adequate, as it yielded a good balance between sensitivity and specificity. Consequently, this screening instrument may help to bridge the gap between general mental health/addiction services and specialized services and thereby making it easier for people with undetected needs caused by ID to get appropriate support (Sondenaa et al., 2011).

This study also examined the possible influence of having a psychiatric disorder on the HASI performance in an attempt to refute the claim of over-inclusiveness of the HASI. After all, it has been suggested that the HASI score might be distorted by the presence of a substance disorder or another psychiatric illness (Hayes, 2000, 2002). Having a psychiatric disorder did not influence the HASI performance in this study. The presence of a psychiatric illness proved to have no effect on the HASI outcome. Therefore, we infer that based on this sample the HASI with the original cut-off score of 85 does not identify individuals with a substance abuse problem or suffering from a psychiatric illness instead of a possible

intellectual disability, thereby broadening the scope of the usability of the HASI. Finally, this study also controlled for the possible influence of medication use on the HASI performance.

Although the HASI appears to be a quick and accurate method of identifying those persons with a substance abuse problem in mental health settings who may have an ID, this study has some limitations. Due to the sampling method, first addressing persons with a substance abuse problem in addiction services and then expanding the sample to the broad mental health setting, a heterogeneous sample is used in this study. Furthermore, the ROC curve analysis is conducted on a small sample with unequal numbers in both groups. Ideally, a ROC curve analysis should be conducted in a sample of at least 100 participants (Schoonjans, 1998; Sondenaa, Bjorgen, & Nottestad, 2007) with equal numbers in both groups (Ford, 2008). Therefore, our results should be interpreted with caution. Additionally, the formal assessment of ID should also include adaptive measures rather than just IQ and confirming that intellectual problems were present since childhood (Sondenaa et al., 20007). At last, comorbid conditions aside from substance abuse were assessed via self-report. A more objective measure to assess comorbid conditions with standardized instruments would have been desirable.

## 5. Conclusions

The results of this study provide support for the validity of the HASI when used in persons with a substance abuse problem in mental health settings. This suggests that the HASI is a suitable instrument to use in this particular group for identifying those who are likely to have an ID, thus addressing a critical need in mental health settings. Furthermore, this study revealed that a possible presence of a psychiatric illness or medication use did not influence the HASI score. Further research is, however, needed to evaluate the instrument in a larger sample.

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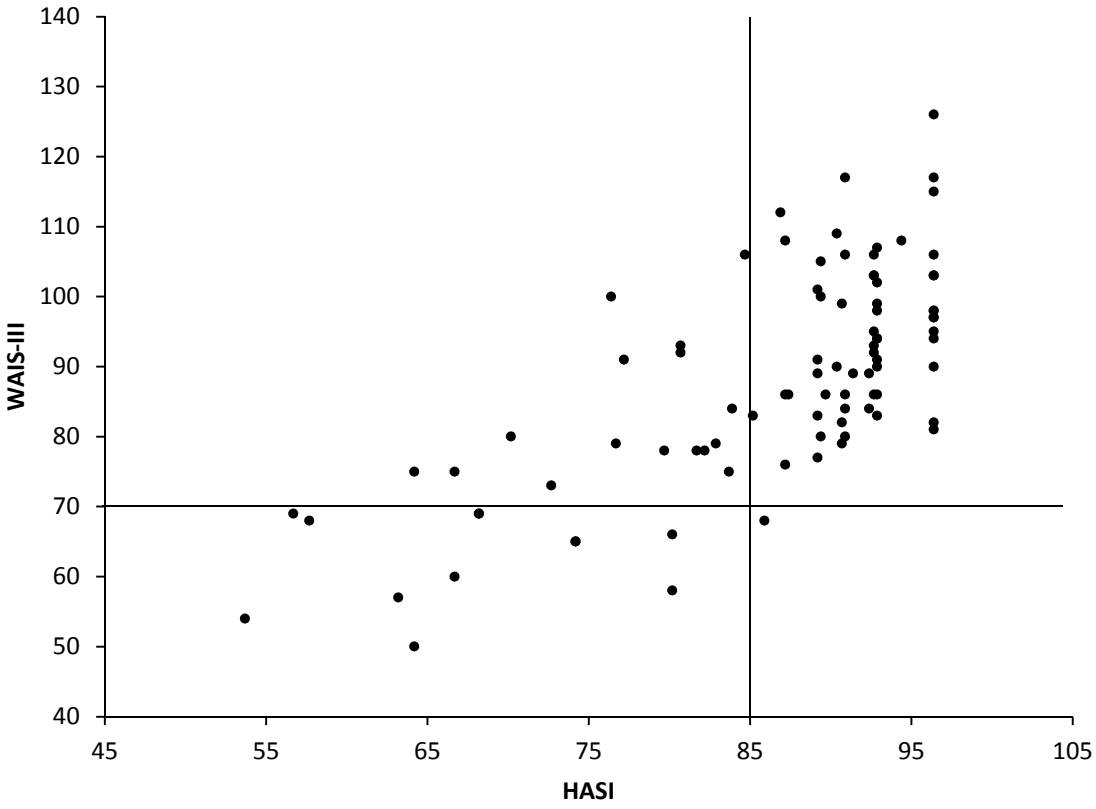


**Figure 1. Scatter-plot and cut-off for HASI and WAIS-III**

**Table 1. Receiver Operating Characteristic (ROC) curve analysis: scores on HASI and WAIS-III at IQ 70 (n = 90)**

| HASI | Area under ROC curve | Possible cut-off scores | Sensitivity | Specificity |
|---|---|---|---|---|
| | .95 | 84.95 | 0.91 | 0.80 |
| | | 85.55 | 0.91 | 0.79 |
| | | 86.40 | 1 | 0.79 |
| | | 87.05 | 1 | 0.77 |